4.0 GROUNDWATER RESOURCES

This section discusses the groundwater physical setting for the Lake Davis Pike Eradication Project. The geology and hydrogeology of the project area are discussed with regard to potential impacts associated with the Proposed Project/Proposed Action and the alternatives. The impact analysis in this section focuses on groundwater levels and water quality. Concerns about public drinking water supplies and potential human health risk are addressed in Section 13, Public Services, and Section 14, Human and Ecological Health Concerns.

4.1 Environmental Setting/Affected Environment

This section describes the environmental setting with respect to groundwater resources. The geology/hydrogeology of the project area and the groundwater regulatory environment are discussed as well.

4.1.1 Geology and Hydrogeology

The geology and hydrogeology influence groundwater levels and movement in the Lake Davis area. Generally, groundwater flow is perpendicular to topographic contours following the pattern of topographic relief in the Lake Davis area. This fact is complicated by fractures in the bedrock, which can be discontinuous, intersecting some wells but not others. These factors and their influence on groundwater are discussed below.

4.1.1.1 Geology

The geology of the Lake Davis area is generally a fractured bedrock system overlain by Pleistocene lake deposits. It is complicated by the presence of fractured bedrock and intersecting faults. Important geologic features of the region include numerous springs and seeps, a bedrock aquifer, a surficial aquifer, lacustrine deposits from a Pleistocene lake, and fractured granitic rock (Gardner 1999). Understanding of the nature of these features is pertinent to the understanding of groundwater resources in the project area.

Grizzly Valley, the basin where Lake Davis is located, was formed as a result of movement of the Lake Davis fault. The Pleistocene lake that occupied the valley filled with fine sediments over time. Due to additional movement of the fault, this lake was drained as water flowed out of the south end of the valley basin. The flow eroded previously deposited alluvial sediments. The shifting of faults produced fractures in the bedrock, increasing permeability by providing a route for water to move through the rock. The locations of the modern fault lines are evident in the areas surrounding Lake Davis due to the presence of springs and vegetation indicating higher permeability of the bedrock than in the surrounding formations (Gardner 1999).

The bedrock aquifer between Lake Davis and the City of Portola is comprised of (1) granite and inclusions of metamorphic “basement” rock, and (2) intrusive andesitic and basaltic volcanic rock. These rocks have relatively low hydraulic conductivity and low ability to transmit groundwater between Lake Davis and the City of Portola.

In many areas around the reservoir, the bedrock has fractured as a result of movement along the faults. These fractures may occur in any direction and create channels through which groundwater may move. Fracture sets are not uniformly distributed over the entire area.

Fractures may intersect one groundwater well but not intersect and well immediately adjacent. Therefore, the hydraulic behavior of wells drilled into the fractured rock may vary greatly.

The surficial aquifer in the highlands surrounding the reservoir is comprised of andesitic pyroclastic rocks. The hydraulic conductivities of these rocks can vary from very low to high, depending on the degree of weathering. This aquifer provides underflow and seepage into the reservoir and also provides recharge to groundwater wells.

The geologic deposits within Grizzly Valley where the reservoir now exists are comprised of clays interbedded with silts, silty sands, and clayey sand. These deposits have been exposed along the edges of the reservoir due to erosion along Big Grizzly Creek and excavation during the construction of Grizzly Valley Dam.

At Grizzly Valley Dam, the valley walls are comprised of fractured variably weathered granitic rock. An andesitic volcanic rock dike is also exposed in this area. The dike is more fractured than the surrounding rock. In order to reduce seepage under and around the dam, a grout curtain was constructed that extends 25 feet on the dam sides to 50 feet below the dam.

4.1.1.2 Hydrogeology

Groundwater flow in the Lake Davis area is generally perpendicular to topographic contours. Because it is lower than surrounding areas to the east, north and west, Lake Davis is a discharge area for surrounding upland areas. A groundwater ridge is located just to the south of the reservoir. Figure 4-1 is reproduced from the Gardner Report. In this figure, the groundwater contours are highlighted in red for clarity.[1]

The general groundwater flow directions, based on these contours, have been added in blue. The groundwater ridge to the south of the reservoir forces groundwater on the north side of the ridge to flow toward the lake. On the south side of the ridge groundwater flow is to the south. This ridge provides a hydraulic barrier to groundwater flow directly from the reservoir toward the City of Portola to the south (Gardner 1999). The Department of Water Resources (DWR) current groundwater level monitoring work (described below) will provide information about groundwater trends and/or changes in behavior over time.

Springs and seeps above Lake Davis discharge into the reservoir from the surrounding upland areas to the west, east, and north. To the east, the springs may be the result of the fault forcing groundwater to the surface or flow from deeper fracture zones.

[1] The Gardner Report used estimated well locations, well elevations, and water depths and therefore provides only an estimation of area hydrogeology. The Department of Water Resources is currently collecting information on the exact locations and elevations of wells in the Lake Davis area including those that are currently being monitored for water quality by PCEH.

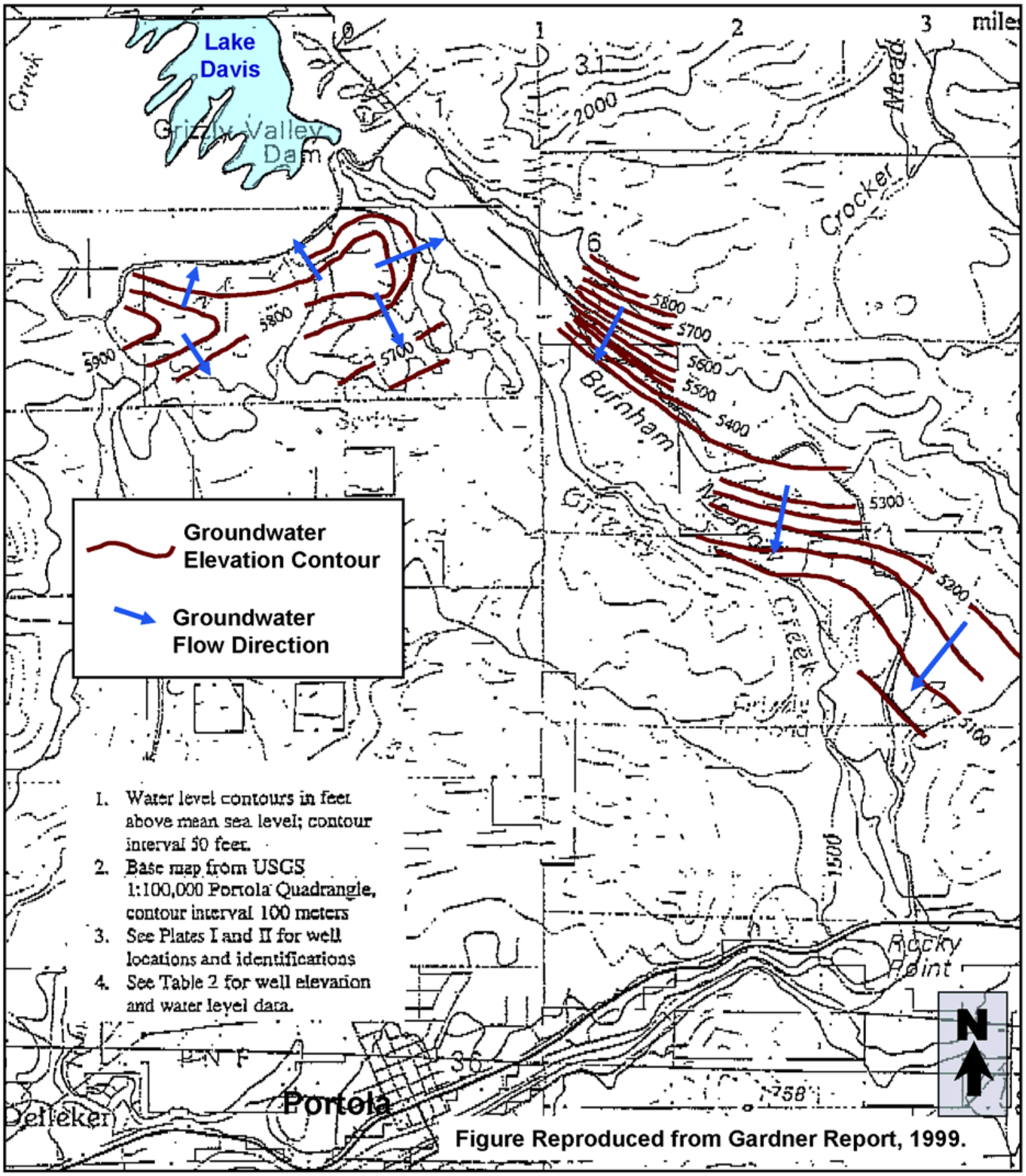

Figure 4-1. Estimated Groundwater Elevation Contours in the Vicinity of Lake Davis

Numerous domestic wells are located east and south of Lake Davis. There are two main groups of wells - those situated on the west flank of Crocker Mountain above and east of Big Grizzly Creek below the dam and those just south of Lake Davis in upland areas west of Big Grizzly Creek. There are also at least two wells in close proximity to Big Grizzly Creek about 3 and 4 miles below Grizzly Valley Dam (Gardner 1999). The USFS well at Grasshopper Flat is due east of Lake Davis, as is the proposed USFS well at Lightning Tree.

Below the dam, groundwater levels in the Big Grizzly Creek ravine are lower than reservoir levels. Therefore, the potential exists for groundwater flow from the reservoir into Big Grizzly Creek sediments and the fractured bedrock (Gardner 1999), and there is some potential for springs in that area to recharge with Lake Davis water. However, the Grizzly Creek canyon is fed by water from surrounding aquifers, including Crocker Mountain and acts as a discharge area for groundwater. Because this area is a groundwater discharge area, it is highly unlikely that any chemical treatment compounds in the water that would flow down the creek after being released from Lake Davis would enter the groundwater aquifers adjacent to the creek (Gardner 1999).

The Gardner Report states that wells further to the south and east of the reservoir do not appear to be threatened by treatment of the reservoir. Municipal wells in the City of Portola draw water from an aquifer that is distinct from Lake Davis. The Gardner Report does state that there is a small but real possibility of water from the reservoir reaching wells down Grizzly Road. Three scenarios for potential seepage of water out of the reservoir are identified:

- Where Lake Davis deposits are coarse-grained enough to permit flow;
- Where Lake Davis deposits were eroded to bedrock prior to the building of the dam; and
- Where Lake Davis deposits were excavated down to bedrock during the construction of the dam.

Based on information review to date and presented in this section, it is not likely that wells down Grizzly Road would be impacted by groundwater flow out of Lake Davis.

In addition to the hydrogeologic evidence presented above, water quality testing has been performed to aid in the evaluation of potential hydraulic connection between the reservoir and nearby supply wells. Water quality testing at wells in the vicinity of the reservoir indicates:

- The groundwater sources for City of Portola (Willow Creek Springs, Maintenance Yard and Commercial Street Park Wells, and a test boring at 6th and Pacific) is not likely from Lake Davis. This is evidenced by chemical signatures between the wells, springs, and Lake Davis water and potentially is caused by the distance of the well from the reservoir; and
- Wells adjacent to the reservoir have similar chemical signatures to Lake Davis water. However, similar signatures do not guarantee hydraulic connection (Gardner 1999).

The Gardner Report recommends that the water quality monitoring program developed by the DHS at the time of the 1997 treatment be augmented with additional sampling locations. Two private residential wells and the Grizzly Lake Resort Improvement District (GLRID) well near the county treatment plant were specifically mentioned. Additional sampling closer to the reservoir along Big Grizzly Creek was deemed necessary based on public concern.

The Department of Health Services regulates the GLRID and the City of Portola public drinking water systems, both of which currently rely on groundwater. A portion of the GLRID lies in and above the Big Grizzly Creek canyon.

The GLRID well is located approximately 5,000 feet downstream from Lake Davis in the Big Grizzly Creek Canyon. Based on data collected by the DWR, this well is cycled on and off on approximately a one week basis. The water is pumped to a holding tank and run through carbon filtration prior to distribution. The well is allowed to equilibrate prior to the next pumping cycle (Figure 4-2). May-July 2006 data from GLRID well indicate pumping levels from about 5,450 feet to approximately 5,370 feet. The estimated elevation of Big Grizzly Creek in this vicinity is approximately 5,420 feet. Long-term monitoring of the groundwater level and pumping activity in the GLRID well by the DWR will provide information regarding how this well may be influenced by Big Grizzly Creek. But, because this area is a groundwater discharge area, it is highly unlikely that any chemical treatment compounds in the water that would flow down the creek after being released from Lake Davis would enter the groundwater aquifers adjacent to the creek (Gardner 1999). In addition, data indicate that the water in the GLRID comes from snowpack or precipitation, rather than a surface water sources (Lawrence Livermore 2003).

There are five Plumas County Environmental Health (PCEH)-regulated public water systems relying on groundwater (<200 connections) near Lake Davis and in the Big Grizzly Creek canyon. The PCEH-regulated systems are Sleepy Hollow Mobile Home Park, Grizzly Ranch, Walton's Grizzly Lodge, Grizzly Creek Ranch, and Grasshopper Campground. A public well system is also proposed at Lightning Tree Campground. Regulations require public water systems to monitor the drinking water quality regularly and keep records. Large public water system purveyors are required to notify the public about their water quality yearly via Consumer Confidence Reports.

The city of Portola relies on wells and springs as described in Section 13.1.3. Based on current conditions, however, existing conditions are barely sufficient to meet existing demand (Marsh, pers. comm. 2006). The City of Portola owns rights to water from four springs on Beckwourth Peak, a yet untapped resource capable of producing an additional 170 gpm of drinking water for public use. The Plumas County Water Treatment Plant was used in treating water from Lake Davis. However, Lake Davis water was eliminated temporarily from the water supply prior to the 1997 treatment and construction of a new plant is anticipated (see Section 2). See Section 13.2.4.4 for an analysis of the impacts of the proposed treatment on domestic water supplies including a new treatment plant, future use of Lake Davis and continued use of city wells. For a discussion of the City of Portola's reliance on groundwater for domestic supply, see also Section 13.1.3. Smaller public water systems, including GLRID, are discussed in this section.

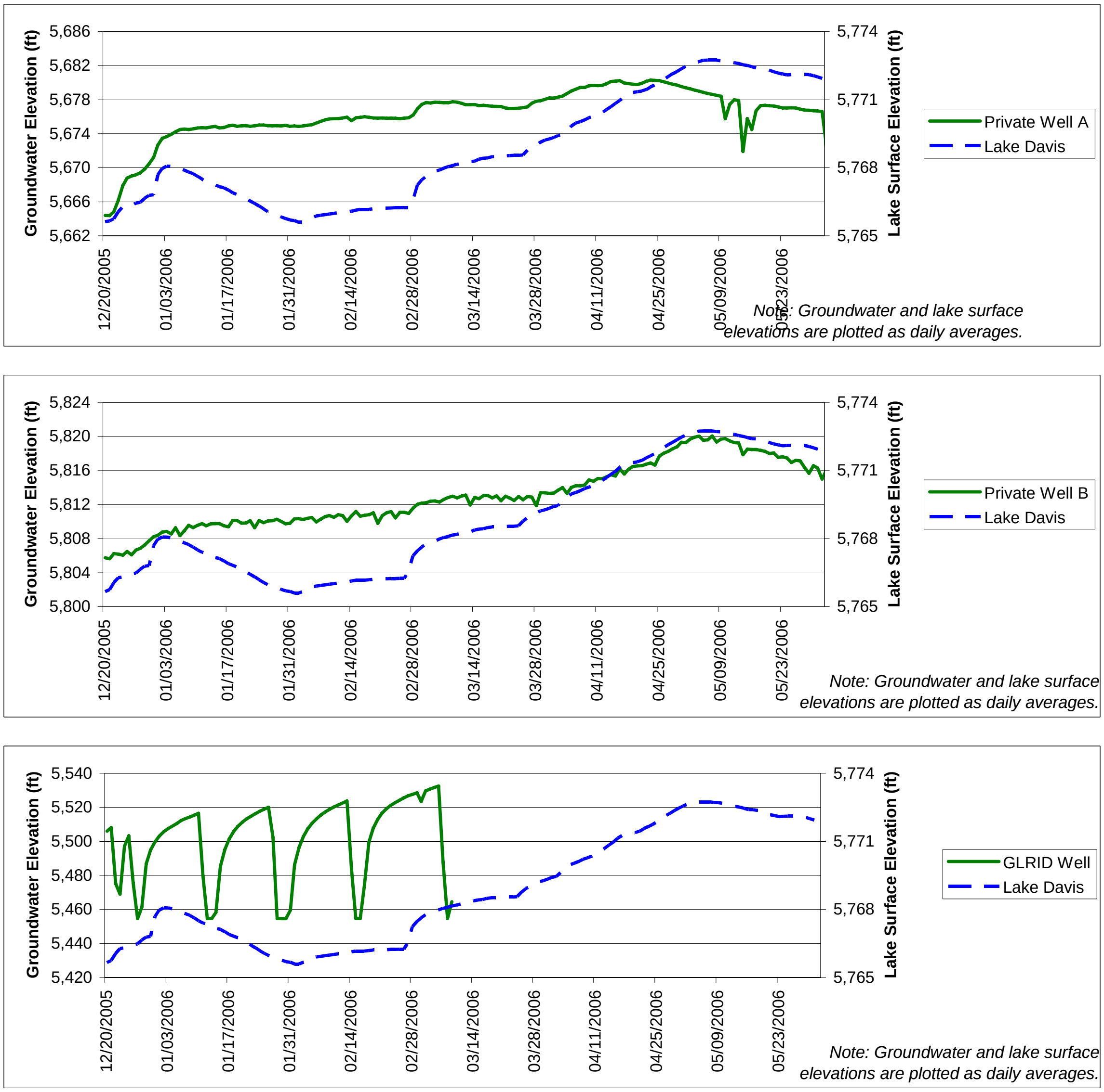

Figure 4-2. Lake Level Compared to Groundwater Levels[2]

4.1.1.3 Groundwater Data

Water Level Data

The DFG has contracted with the DWR to map wells and monitor groundwater levels in the Lake Davis area. The program includes measurements at a number of locations including the installation of automatic water level measurement devices in selected wells. This program will also establish a groundwater monitoring grid in the project area as well as regular

[2] The data on Figure 4-2 is represented on two separate vertical axes. The elevation of the groundwater level (green line) is read off the left axis. The elevation of the reservoir surface (blue line) is read off the right axis. For example, on March 14, 2006, the groundwater level at Private Well A is 5,677 feet and the reservoir surface is at 5,768 feet.

collection of water level data, mapping of wells in the watershed, characterization of groundwater movement, and identification of influences on groundwater levels and flow in the area. Two sources of water level data are discussed below.

Continuously Recorded Groundwater Level Data

Continuously recorded water level data collected by DWR has been reviewed to assess potential connections between the reservoir and two private wells (“A” and “B”) and Big Grizzly Creek and a public well (GLRID). Figure 4-2 presents the observed water levels at these three wells and measured reservoir levels from December 2005 through May 2006. This data collection effort is ongoing.

Analysis of trends and similarities to reservoir levels in the private wells can be done because water levels in these wells are not affected by pumping within the wells themselves. The wide fluctuations observed at the GLRID well are due to normal operational pumping cycles. Recent data collected by GLRID since June 2006 indicates that pumping levels of the GLRID well can drop below the estimated level of the creek. This data presents a scenario that the GLRID well could pull water from Big Grizzly Creek (although previous water tests indicate that this well is recharged through snowpack and rainfall as described under (Lawrence Livermore 2003).

There are periods of time that groundwater and reservoir levels follow the same pattern; however, this is not consistent over the entire period. For example, during January groundwater and reservoir levels are moving in opposite directions. From February through March, groundwater and reservoir levels move in similar directions. However, note that the water level in Private Well “A” begins to drop in mid-April while the reservoir level does not begin to drop until early May. This indicates that the reservoir level may not be the driving force for the groundwater levels at this well. Further monitoring of well water levels by the DWR will provide information regarding groundwater trends, influences, and/or seasonal fluctuations.

Based on measurements of reservoir surface levels and groundwater levels in the two private wells and the GLRID well during the span of time shown in Figure 4-3, it appears unlikely that the water level in Lake Davis is driving the groundwater levels in these three wells. Rather, it is likely that another stress is inducing the changes in groundwater level seen in these wells. Figure 4-3 shows the correlation between measured groundwater levels and precipitation measured at the DWR’s Lake Davis station. At the private wells, groundwater levels increase directly after precipitation events. For example, water levels in both wells rose during the wet period of late December 2005. Groundwater levels also increase, after the late February 2006 precipitation event. Groundwater levels continue to rise during the generally wet period of March and April. As mentioned earlier, correlation between water level and precipitation in the GLRID well is difficult to make due to the relatively severe water level changes caused directly by normal operational pumping cycles.

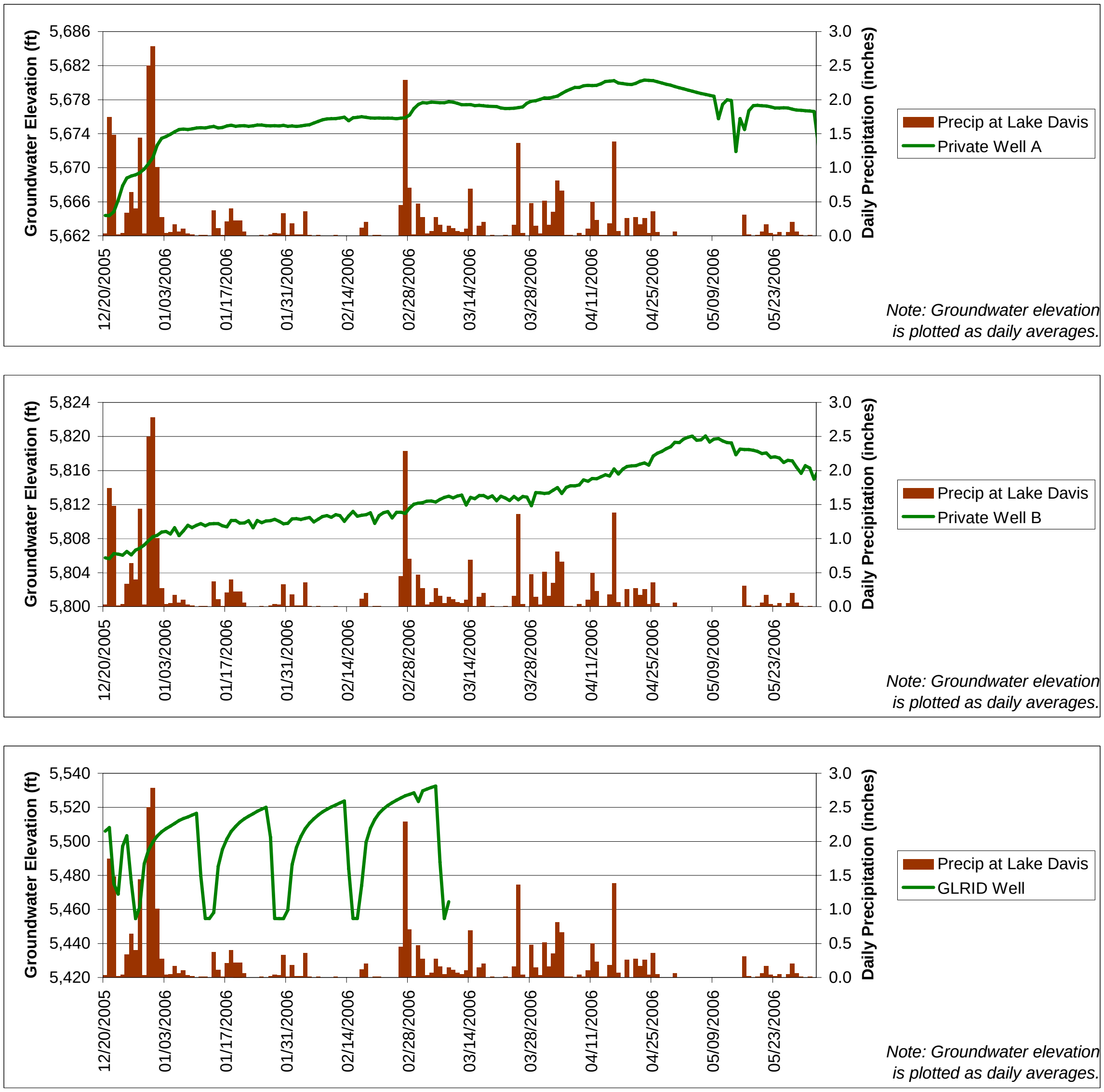

Figure 4-3. Groundwater Levels Compared to Precipitation

June 2006 Groundwater Level Monitoring

As part of the DWR groundwater program, groundwater elevation information was collected in 17 wells in mid-June 2006. This information was collected to supplement data analysis done by Leland R. Gardner and Associates in 1999 which only estimated groundwater elevations in the wells. Table 4.1-1 presents the measured water level elevations of these wells.

Table 4.1-1. Groundwater Level Monitoring, June 2006

Well Number	May (5/17–5/18) Depth to Groundwater	June (6/19–6/20) Depth to Groundwater	Well Surveyed Elevation	May Groundwater Elevation	June Groundwater Elevation
	Feet	Feet	Feet	Feet	Feet
08K04	36.4	37.3	5430.7	5394.3	5393.4
08K03	12.9	13.1	5361.6	5348.7	5348.5
08K02	23.8	18.8	5400.8	5377.0	5382.0
08K01	48.6	47.3	5415.9	5367.3	5368.6
08K05	10.6	11.1	5331.1	5320.5	5320.0
11A05	34.0	41.2	5814.5	5780.5	5773.3
11A04	32.1	38.7	5811.4	5779.3	5772.7
11A03	33.5	39.9	5814.4	5781.0	5774.5
10H01	18.2	22.1	5836.8	5818.6	5814.7
11A02	19.8	25.6	5808.4	5788.6	5782.8
11A01	81.1	79.6	5869.6	5788.5	5790.0
11A06	63.0	75.6	5859.1	5796.1	5783.5
11H03	53.1	58.4	5840.5	5787.4	5782.1
21D03	37.7	40.7	5045.0	5007.4	5004.3
21D01	36.2	38.1	5037.0	5000.8	4998.9
11H02	66.7	76.3	5887.2	5820.5	5810.9
11H01	80.8	89.5	5902.9	5822.1	5813.4

Source: DWR Northern District, June 2006.

Figure 4-4 presents the water levels that are in the immediate vicinity of Lake Davis. The posted values are the average of the May and June measurement. These groundwater elevations range from 5,683 feet to 5,930 feet. As shown in Figure 4-2, reservoir levels ranged from 5,676 feet to 5,765 feet. Therefore, during this period of time groundwater levels in the wells are all above the current reservoir level, suggesting that groundwater flow is towards the reservoir as previous reported.

Water Quality Data

A two-phase groundwater quality monitoring program of (1) DFG and DHS sampling immediately post-treatment, and (2) an ongoing PCEH groundwater well monitoring was included as part of the 1997 eradication project. These programs have demonstrated and continue to demonstrate that groundwater quality was not affected by the chemical treatment of Lake Davis. Groundwater monitoring as part of other rotenone projects in the state have shown results that are consistent with these results. Provided below is a description of the various groundwater quality monitoring and data collection efforts in the Lake Davis area.

Post-1997 Treatment Water Quality Sampling by DFG and DHS

Following the mid-October 1997 treatment of Lake Davis, monitoring of reservoir water and sediment was conducted by the DFG and DHS through August 4, 1998. The chemical constituents of the rotenone formulation were no longer detected in samples collected after July 16, 1998. The following samples were collected and analyzed.

- Water and sediment from Lake Davis,
  - rotenone and rotenolone,
  - volatile organic compounds (VOCs),
  - semi-volatile organic compounds (semi-VOCs),
  - piperonyl butoxide (PBO),
  - biological oxygen demand (BOD), pH, alkalinity, hardness, total organic carbon (TOC), conductivity, and ammonia; and
- Water from Big Grizzly Creek,
  - rotenone and rotenolone,
  - volatile organic compounds (VOCs),
  - semi-volatile organic compounds (semi-VOCs).

The following information summarizes the results of water and sediment quality sampling performed by the DFG and DHS following the 1997 treatment. Information is summarized here to provide a synopsis of the test results.

- Water,
  - The measured levels of rotenone and rotenolone in the reservoir dropped below detection limits (2 μg/L) within 48 days following the treatment. Based on sampling results, the half-life of rotenone was calculated to be 7.7 days in Lake Davis during the 1997 treatment. The half-life of rotenone is the time required for half of the chemical to break down. After one half-life, 50 percent of the original compound remains, after two half-lives, 25 percent (half of the remaining 50 percent) remains. This process continues indefinitely,
  - No VOCs were detected in the reservoir one week following the treatment,
  - No semi-VOCs were detected in the reservoir two weeks following the treatment,
  - PBO was detected for 39 weeks following the treatment,
  - The last date sampling detected rotenone in Big Grizzly Creek was November 20, 1997. Final sampling occurred on November 26, 1997; and

Figure 4-4. Measured Groundwater Elevations, May/June 2006

Figure 4-4 BACK

- Sediment,
  - The measured levels of rotenone and rotenolone in Lake Davis bottom sediments had dropped below detection limits (2 g/L) 55 days after treatment,
  - No VOCs were detected in sediment samples,
  - Semi-VOCs (naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene) were detected in sediment samples. Measured levels of these compounds dropped below detection limits 55 days after treatment.

Rotenone Treatments and Groundwater Testing by DFG

The DFG has monitored wells as part of nine rotenone applications projects throughout the state. In fifteen years of monitoring the effects of rotenone application to streams and lakes, the DFG has found that the behavior of rotenone and organic compounds is dictated by the dilution, temperature, and alkalinity of the treated water. The degradation rates for rotenolone and the synergist piperonyl butoxide decrease at lower water temperatures and the chemicals may persist for up to nine months in colder waters. All other components of rotenone application degrade or dissipate within six weeks in water samples. Chemicals were found in the sediments of treated water bodies for up to 180 days following rotenone application, but no evidence was found of rotenone or the associated chemicals in groundwater or wells neighboring the treatment areas (DFG 2001a).

Ongoing Groundwater Monitoring Activities by PCEH

In addition to the DFG and DHS water quality sampling program, the PCEH groundwater sampling program tests nearly 80 groundwater annually (and two wells semi-annually) for piperonyl butoxide (PBO) and volatile organic compounds (VOCs). This program was implemented in response to public concerns that groundwater quality could have been influenced by the 1997 rotenone treatment of Lake Davis. A summary of the results of the sampling program through 2005 is shown in Table 4.1-2. The wells with detections and the detection concentrations are detailed in Table 4.1-3 (nondetect results are not shown). This is a ten-year sampling program scheduled to be completed in 2008. Recently, Plumas County Environmental Health (PCEH) hired Lawrence Livermore National Laboratory (LLNL) to evaluate the program and make recommendations for any future testing programs. A summary of the pertinent results are as follows (Ridley, personal communication, 2006):

- 1,224 samples have been collected over a 7-year period. There were four verified detections in five locations (a verified detection is a consistent detection of a compound at a well). All detections were at levels below the maximum contaminant levels (MCLs) for drinking water.
- PBO was not detected.
- There was a verified detection of toluene. Toluene was found in the Nusyn-Noxfish® solution used to treat the reservoir in 1997, but due to dilution was never detected in Lake Davis. The toluene detection here may be the result of a pump replacements at the well.

- There was an inconsistent and unverified detection of trichloroethylene at one well. The concentrations detected, well location and inconsistent detections do not suggest any connection with the 1997 rotenone treatment of Lake Davis. TCE is a very common contaminant in our society.
- None of the chemical detections indicated any spatial or temporal pattern that might suggest the 1997 application as the source.

Following the 1997 treatment of Lake Davis, PCEH asked the Lawrence Livermore National Laboratories (LLNL) to assist in validating the DFG and DHS surface water, sediment and groundwater results and the results of the concurrent PCEH well sampling program.

Lawrence Livermore National Laboratory Groundwater Age Dating

In 2003, at the request of the Lake Davis Steering Committee, LLNL analyzed one water samples each from two private wells (one in Big Grizzly Creek Canyon and one along Lake Davis Road), the GLRID well, two City of Portola wells, and Willow Creek Springs. Using an age-dating technique analyzing tritium and helium components of groundwater, scientists from LLNL were able to determine the year that each groundwater sample collected was last exposed to the earth's atmosphere (LLNL 2003).

In a related examination, sources and recharge avenues for the groundwater were examined through the measurement of noble gases (neon, argon, krypton, and xenon) and stable isotopes of oxygen in the water. The presence of levels of noble gases that exceed surface levels in the area where the water was sampled indicates the water in the samples percolated through the unsaturated, or vadose, zone prior to entering the groundwater. Water which does not show signs of traveling through the vadose zone may have elevated levels of oxygen-16, which concentrates in bodies of water with large surface areas, such as creeks and lakes. The presence of oxygen-16 indicates the groundwater samples originated from a surface water source.

The LLNL investigation results indicate that the private well in the Big Grizzly Creek Canyon receives roughly 30 percent of its water from a surface water source, probably Lake Davis or Big Grizzly Creek. The other wells are predominantly fed by precipitation. This private well and the Commercial Street well contained the oldest water, measured at 27 and 37 years, respectively. The Corporation (Maintenance) Yard well sample was determined to contain water 14 years old, while the other private well, GLRID well, and Willow Springs samples were measured at 14, 10, and 2 years, respectively.

Table 4.1-2. PCEH Water Quality Test Summary

Year	No. of Wells in Program	No. of Wells Tested(1)	No. of Wells Where Compound Detected(2)	No. of Wells Where No Compound Detected	Contaminant Identified(3)	Notes; Possible Source
1999	81	67	0	67	none	
2000	81	71	3	68	Toluene	Pump replacement could have introduced compound
					MTBE	Re-test performed - not detected in second sample
					Methylene Chloride	Re-test performed - not detected in second sample
2001	81	78(4)	2	76	MTBE	Re-test performed - not detected in second sample
					Freon 12	Re-test performed - not detected in second sample
2002	78	75(4)	3	75	Toluene	Pump replacement could have introduced compound
					Chloromethane	Re-test performed - not detected in second sample
					Methylene Chloride	Unable to contact owner for re-test
2003	78	75(4)	2	73	MTBE	Re-test performed - not detected in second sample
					TCE	Re-test performed - not detected in second sample
2004	77	75(5)	5	70	Chloroform	Re-test performed - not detected in second sample
					TCE	Re-test performed - not detected in second sample
					Naphthalene	Re-test performed - not detected in second sample
					Naphthalene	Re-test performed - not detected in second sample
					Methylene Chloride	Unable to re-test this year
2005	76	71	6	65	Toluene	Pump replacement could have introduced compound
					Toluene	Re-test performed - detected at a slightly lower level
					Toluene	Re-test performed - not detected in second sample
					Toluene	Re-test performed - not detected in second sample
					Dichlorodifluoromethane	Re-test performed - not detected in second sample
					Dichlorodifluoromethane	Re-test performed - detected at a slightly higher level

Notes:

(1) None of the wells tested has shown any PBO present.
(2) None of the positive tests for VOCs exceeded the Maximum Contaminant Level allowable for drinking water.
(3) Most of the VOCs found are in common use in most households.
(4) Three well owners declined participation(5) One well owner requested removal from program

Source: Plumas County Environmental Health

Five wells in the Lake Davis project area were monitored in 1997, at 5, 14, 90, 194, and 324 days after treatment. No detectable concentrations of rotenone, rotenolone, volatile organic compounds and semi VOCs were measured in any of the wells, using methods appropriate for drinking water standards. No PBO was detected either (Finlayson et al. 2001).

Table 4.1-3. PCEH Water Quality Test Results; Summary of Wells with Positive Results

		Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7	
No.	Well	Summer 1999	Winter 2000	Summer 2000	Winter 2001	Summer 2001	Winter 2002	Summer 2002	Winter 2003	Summer 2003	Winter 2004	Summer 2004	Winter 2005	Summer 2005	Winter 2006
3	**025-490-015**														
	Toluene 7/19/05													**20 µg/L**	
	Retested 8/29/05													**2.1 µg/L**	
10	**025-500-007**														
	Dichlorodifluoromethane														
	7/26/2005													**0.53 µg/L**	
	Retested 8/29/05													**0.63 µg/L**	
12	**025-251-003**														
	Dichlorodifluoromethane														
	8/2/2001					**0.71 µg/L**									
	MTBE														
	7/23/2003									**3.6 µg/L**					
	Retested 9/2/2003									**ND**					
19	**025-270-014**														
	Naphthalene														
	8/16/2004											**1.0 µg/L**			
	Retested 9/20/2004											**ND**			
22	**025-490-016**														
	Toluene														
	7/19/2005													**0.83 µg/L**	
	Retest 8/29/2005													**ND**	
28	**025-303-001**														
	Methylene Chloride														
	1999	**ND**													
	11/6/2000			**5.9 µg/L**											
	2001					**ND**									
	7/26/2002							**2.5 µg/L**							
	2003									**X**					
	8/23/2004											**2.0 µg/L**			
	2005													**X**	
30	**025-240-085**														
	MTBE														
	9/1/2000			**1.9 µg/L**											
	Retest 10/3/2000			**ND**											
	Retest 11/16/2000			**ND**											
	Toluene														
	7/25/2005													**2.2 µg/L**	
	Retest 8/29/2005													**ND**	

Table 4.1-3. PCEH Water Quality Test Results; Summary of Wells with Positive Results

		Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7	
No.	**Well**	**Summer 1999**	**Winter 2000**	**Summer 2000**	**Winter 2001**	**Summer 2001**	**Winter 2002**	**Summer 2002**	**Winter 2003**	**Summer 2003**	**Winter 2004**	**Summer 2004**	**Winter 2005**	**Summer 2005**	**Winter 2006**
36	**025-350-018**														
	Dichlorodifluoromethane														
	7/26/2001					**0.94 µg/L**									
	Retest 9/4/2001					**ND**									
42	**128-010-048**														
	Chloroform														
	1/21/2004										**2.1 µg/L**				
	3/2/2004										**ND**				
43	**025-260-014**														
	Vinyl Chloride														
	8/5/2003									**0.69 µg/L**					
	Retest 9/2/2003									**ND**					
	Trichloroethene														
	8/5/2003									**1.3 µg/L**					
	Retest 9/2/03									**ND**					
	8/17/2004											**.67 µg/L**			
	Retest 9/20/2004											**ND**			
44	**128-122-005**														
	Toluene														
	8/29/2000			**1.3 µg/L**											
	Retest 10/3/2000			**ND**											
	Pump Replaced 8/16/00														
	Naphthalene														
	8/16/2004											**1.1 µg/L**			
	Retest 9/20/2004											**ND**			
47	**025-500-030**														
	Chloromethane														
	9/4/2002							**.59 µg/L**							
	Retest 10/7/02							**ND**							
50	**128-131-006**														
	Toluene														
	7/17/2002							**.82 µg/L**							
	Well Pump recently														
	replaced before testing														
	was done														
52	**025-350-029**														
	Chloroform														
	8/2/2004											**.69 µg/L**			
	retest 8/23/04											**ND**			

Table 4.1-3. PCEH Water Quality Test Results; Summary of Wells with Positive Results

		Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7	
No.	**Well**	**Summer 1999**	**Winter 2000**	**Summer 2000**	**Winter 2001**	**Summer 2001**	**Winter 2002**	**Summer 2002**	**Winter 2003**	**Summer 2003**	**Winter 2004**	**Summer 2004**	**Winter 2005**	**Summer 2005**	**Winter 2006**
53	**128-010-027 GLRID well**														
	Tetrachloroethene (PCE)														
	8/26/1999	**2.0 µg/L**													
	9/13/2000			**1.1 µg/L**											
	1/23/2001				**1.7 µg/L**										
	8/21/2001					**.85 µg/L**									
	1/10/2002						**.61 µg/L**								
	7/22/2002							**ND**							
	1/28/2003								**.66 µg/L**						
	2/26/2003								**.57 µg/L**						
	7/24/2003									**.76 µg/L**					
	1/21/2004										**0.66 µg/L**				
	8/3/2004											**.62 µg/L**			
	2/14/2005												**ND**		
	7/25/2005													**.53 µg/L**	
	Toluene														
	1/23/2001				**.53 µg/L**										
65	**128-060-036**														
	MTBE														
	7/26/2001					**.72 µg/L**									
	Retest 9/4/01					**ND**									
80	**025-293-008**														
	Toluene														
	7/18/2005													**5.9 µg/L**	
	Retest 8/29/05													**4.1 µg/L**	
	New Pump and Tank														
	Chloroform													**1.7 µg/L**	
	Retest 8/29/05													**ND**	

Notes:
X: Did not Sample
ND: Not Detected

Discussion of Groundwater Level and Quality Data

There is little evidence to suggest that any treatment compounds introduced into Lake Davis in 1997 migrated into the surrounding groundwater. Data show that Lake Davis is primarily a discharge location for groundwater (groundwater flows to the reservoir). The water quality testing done following the 1997 treatment indicates that concentrations of treatment compounds dropped below measurable amounts in a relatively short period of time.

4.1.2 Regulatory Environment

This section presents the Federal, State, and local regulations that affect the project alternatives with regard to groundwater quality and quantity. Also included is a description of the system of groundwater rights in California. The project is subject to groundwater regulations at the Federal and State level by the USEPA and California EPA (CalEPA). In addition, local agencies have the authority to regulate water use in their area of jurisdiction.

4.1.2.1 Federal

Under the Safe Drinking Water Act, the USEPA sets drinking water standards referred to as the National Primary Drinking Water Regulations, 40 CFR Part 141, and the National Secondary Drinking Water Regulations, 40 CFR Part 143. These regulations set maximum contaminant levels (MCLs) for substances in drinking water and apply to groundwater if the groundwater is a source of potable water. Groundwater in the area of project alternatives is currently pumped for beneficial uses (i.e., drinking water supply). Groundwater rights are not subject to Federal regulation.

4.1.2.2 State

Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, was enacted as a ballot initiative in November 1986. The Proposition was intended by its authors to protect California citizens and the State's drinking water sources from chemicals known to cause cancer, birth defects or other reproductive harm, and to inform citizens about exposures to such chemicals.

Water Quality Control Boards

The State Water Quality Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) are responsible for protecting the quality of the waters of the state for present and future beneficial uses. The regional boards formulate, adopt, and implement basin-wide water quality control plans and policies. Plumas County, Lake, Davis, and the City of Portola fall within the Central Valley RWQCB. The Central Valley RWQCB has established beneficial uses for the protection of surface water in its Basin Plan.

In 1968, the State Water Resources Control Board (SWRCB) adopted resolution 68-16, “Statement of policy with Respect to Maintaining High Quality of Waters in California State” establishing a non-degradation policy for the protection of water quality. Under this policy, generally referred to as the “anti-degradation policy,” whenever the existing quality of water exceeds the quality necessary to maintain present and potential beneficial uses of the water, existing water quality must be maintained. This policy pertains to both surface waters and groundwater of the State.

The SWRQCB-Division of Water Rights is responsible for the water rights in the State of California. Groundwater use is not subject to Federal regulation and is subject to limited statewide and local regulation. In the State of California, rights to surface waters include the control of groundwater collection that affects the levels of neighboring surface waters. Overlying rights limit the amount of water a landowner whose land overlies a groundwater source can remove from the source. Overlying rights are designed to provide a reasonable share of a groundwater source to each of the landowners overlying the source for reasonable, beneficial use. Appropriative rights allow an appropriator to withdraw the surplus water for use on non-overlying lands. Prescriptive rights may be attained when an appropriator uses water in a way that goes against the reasonable, beneficial uses of other overliers or appropriators without incurring legal action by other users. The rights of appropriators may be diminished in an overdraft period, in which more water is required of an underground basin than the basin can reasonably provide. The overdraft period stops the development of new appropriations and may force the cessation of pumping by appropriators if parties with overlying rights require a larger share of the basin resources. (SWRCB 1990)

Department of Health Services

The Department of Health Services (DHS) Health and Safety Code Section 116751 prevents the DFG from introducing a poison (e.g., pesticide) to a drinking water supply for purposes of fishery management unless the DHS determines that the activity will not have a permanent adverse impact on the quality of the drinking water supply or wells connected to the drinking water supply. The DHS is responsible for evaluating the short- and long-term effects of the pesticide on drinking water. DHS is also responsible for ensuring that an alternate supply of drinking water is available to parties that rely on the contaminated supply while the chemical treatment activity is taking place.

Title 22, Division 4, Chapter 15 of the California Code of Regulations establishes Maximum Contaminant Levels (MCLs) for public water systems. Groundwater in the area of the Proposed Project is currently used for drinking water. (A comparison of compounds found in CFT Legumine® and NoxFish® to the relevant MCLs is provided in Table 4.2-1 in Section 4.2.) DHS has set “notification levels” for other components of CFT Legumine® and NoxFish®, and requires non-detect for contaminants in water that may not have MCLs (H&S Code Section 11675 also applies). DHS has the authority to set advisory levels.

Office of Environmental Health Hazard Assessment

The Office of Environmental Health Hazard Assessment, which is part of the California EPA, is responsible for assessing health risks posed to the public by chemical contaminants. The Water Toxicology Unit performs major risk assessment and hazard evaluation activities relating to chemical contaminants in drinking water. These activities include developing health advisories, Notification Levels, and public health goals for chemical substances in drinking water, and providing toxicological assistance for chemical monitoring activities for the drinking water supply. The program also provides education to the public and other governmental agencies on drinking water contamination and drinking water regulatory standards development. The process of establishing a public health goal (PHG) ensures that the PHG is set at a level that does not pose significant health risk to the public.

California Integrated Waste Management Board

The California Integrated Waste Management Board (CIWMB) oversees the disposal of solid waste by local agencies. California Title 27 regulations require prevention of groundwater pollution by landfill leachate for as long as the wastes in the landfill will be a threat.

Department of Conservation

The Department of Conservation is responsible for preventing contamination of groundwater resulting from the drilling, maintenance, and destruction of oil, gas, and geothermal wells.

Department of Toxic Substances Control

The Department of Toxic Substances Control (DTSC) has statutory responsibility to protect public health and the environment from the improper handling, storage, transport, and disposal of hazardous wastes. USEPA authorized DTSC to implement the Resource Conservation and Recovery Act (RCRA) program in California, while the Department of Pesticide Regulation has statutory responsibility to prevent pesticide pollution of groundwater that may be used for drinking water supplies.

4.1.2.3 Local Regulations

Many local agencies, districts, and other entities identified in the California Water Code have the authority to develop forms of groundwater management regulations. Some of these agencies have actively managed their groundwater resources. Examples of the types of agencies that may have statutory authority to manage groundwater include California water districts, community services districts, flood control and water conservation districts, irrigation districts, municipal utility districts, reclamation districts, water conservation districts, water replenishment districts, and water storage districts.

The PCEH is responsible for ensuring the quality of drinking water for small public water systems (<200 connections). At this time, there is no local groundwater management plan pursuant to the Groundwater Management Act that covers the City of Portola or Plumas County.

4.2 Environmental Impacts and Consequences

The proposed treatment plan involves using one of two different formulations of rotenone products, CFT Legumine® and NoxFish®. Table 4.2-1 presents a list of compounds associated with each of these formulations and the concentrations of each chemical within each formulation. To reach the desired rotenone concentration of 50 ppb in the reservoir water, the formulations would be diluted. The dilution factors, assuming either CFT Legumine® or NoxFish® is used, are also shown in the Table 4.2-1. The estimated in-

Table 4.2-1. Summary of Treatment Chemicals and MCLs

Chemical Compound	Concentration in Formation	Target Concentration in Reservoir Water	Dilution Factor	Expected Concentration in Lake Water*		CA DHS Drinking Water Maximum Contaminant Level (MCL)	Could MCL be Exceeded?	CA DHS Drinking Water Notification Level	Could NL be Exceeded?
	mg/L (ppm)	ppb		mg/L (ppm)	µg/L (ppb)	mg/L		mg/L	
CFT Legumine								No NL Set	
Rotenone	43,200	50	864,000 : 1	0.05	50	No MCL Set	N/A	No NL Set	N/A
Rotenolone	5,300			0.0061	6.1	No MCL Set	N/A	No NL Set	N/A
1-Methyl-2-pyrrolidinone								No NL Set	N/A
(Methyl pyrrolidone)	90,000			0.1042	104.2	No MCL Set	N/A	No NL Set	N/A
Diethylene glycol monoethyl ether								No NL Set	N/A
(Diethylene glycol ethyl ether)	569,000			0.6586	658.6	No MCL Set	N/A	No NL Set	N/A
1,3,5-Trimethylbenzene (mesitylene)	4			4.63E-06	0.00463	No MCL Set	N/A	0.33	No
sec-Butylbenzene	3.9			4.51E-06	0.00451	No MCL Set	N/A	0.26	No
1-Butylbenzene (n-Butylbenzene)	80			9.26E-05	0.09259	No MCL Set	N/A	0.07	Yes
4-Isopropyltoluene								No NL Set	N/A
(p-Isopropyltoluene)	5			5.90E-06	0.0059	No MCL Set	N/A	No NL Set	N/A
Methylnaphthalene	140			1.62E-04	0.16204	No MCL Set	N/A	No NL Set	N/A
Naphthalene	350			4.05E-04	0.40509	No MCL Set	N/A	0.017	No
Noxfish								No NL Set	N/A
Rotenone	50,000	50	1,000,000:1	0.05	50	No MCL Set	N/A	No NL Set	N/A
Trichloroethene								No NL Set	N/A
(Trichloroethylene, TCE)	73			0.000073	0.073	0.005	No	No NL Set	N/A
Toluene	1,800			0.0018	1.8	0.15	No	No NL Set	N/A
1,3- and/or 1,4-Xylene								No NL Set	N/A
(M/p xylene)	610			0.0006	0.61	1.75	No	No NL Set	N/A
1,2-Xylene (o xylene)	76			0.000076	0.076	No MCL Set	No	No NL Set	N/A
Isopropylbenzene	52			0.00005	0.052	No MCL Set	No	No NL Set	N/A
1-Propylbenzene	310			0.00031	0.31	No MCL Set	No	0.77	No

Table 4.2-1. Summary of Treatment Chemicals and MCLs

Chemical Compound	Concentration in Formation	Target Concentration in Reservoir Water	Dilution Factor	Expected Concentration in Lake Water*		CA DHS Drinking Water Maximum Contaminant Level (MCL)	Could MCL be Exceeded?	CA DHS Drinking Water Notification Level	Could NL be Exceeded?
	mg/L (ppm)	ppb		mg/L (ppm)	µg/L (ppb)	mg/L		mg/L	
(n-Propylbenzene)								0.26	Yes
1,3,5-Trimethylbenzene	860			0.00086	0.86	No MCL Set	No	0.33	Yes
1,2,4-Trimethylbenzene	10,000			0.01	10	No MCL Set	No	0.33	Yes
1-Butylbenzene								No NL Set	N/A
(n-Butylbenzene)	9,000			0.009	9	No MCL Set	No	No NL Set	N/A
4-Isopropyltoluene								No NL Set	N/A
(p-Isopropyltoluene)	1,000			0.001	1	No MCL Set	No	No NL Set	N/A
Naphthalene									
via EPA method 8260	70,000			0.07	70	No MCL Set	No	0.017	Yes
via EPA method 8270	28,000			0.028	28	No MCL Set	No	0.017	Yes

Notes
* If using 100 percent of single formulation

reservoir concentrations of each of the formulation components were calculated based on these dilution factors.

4.2.1 Evaluation Criteria and Environmental Concerns

Potential impact to potable groundwater wells is viewed as an environmental concern. The Proposed Project/Proposed Action and project alternatives have the potential to impact wells through changes in groundwater levels and groundwater quality. Each impact is discussed according to two different locations for the area of potential effect: near the reservoir and in the Big Grizzly Creek watershed below the dam and in the Portola area.

4.2.1.1 Groundwater Levels

Change in groundwater levels is a key environmental concern for the potential to affect existing wells. The Proposed Project/Proposed Action and project alternatives would result in the lowering of the reservoir water surface elevation with the exception of the No Project alternative and Alternative D. Changes in the water surface elevation may result in changes in groundwater levels in the aquifer units adjacent to Lake Davis. Changes in static groundwater level would be a function of the amount the reservoir surface elevation has dropped and the hydrogeologic properties of the surrounding aquifer units. The drop in groundwater levels decreases with distance from the reservoir and, at some distance from the reservoir, groundwater levels will be unaffected by changes in reservoir surface elevation.

If the static groundwater level in the vicinity of a pumping well declines, the production capacity of the well can be adversely impacted. A decrease in the water level in a well would result in a decrease in pumping capacity due to a drop in the height of water above the pump in the well. With less water above the pump, it is likely that the production capacity of the well would be decreased. In the worst case, the groundwater level in the well would drop below the elevation of the pump resulting in the loss of production capacity. As the reservoir refills, water levels in the surrounding aquifers would recover to pre-drawdown levels assuming all other conditions remain the same.

Neutralization options evaluated in Section 4.2.4.5 require limiting the outflow from the dam to control the release of rotenone-treated water and to allow adequate time for neutralization limiting the outflow would reduce flow in Big Grizzly Creek below the dam.

To make an assessment of impact on groundwater levels at a well, the following data are required:

- Change in reservoir level;
- Deep percolation (primarily a function of precipitation);
- Depth and elevation of the well;
- Distance of the well from the reservoir;
- Initial and pumping water levels in the well; and
- Hydraulic properties of the aquifer where the well is open/perforated.

4.2.1.2 Water Quality

If water levels in the reservoir are higher than in the surrounding aquifer, the potential exists for seepage of reservoir water and the dissolved treatment chemicals into the surrounding aquifer. Consequently, the environmental concern to be addressed is whether there is potential for the chemical compounds in the rotenone formulations to enter potable water supply wells.

Table 4.1-4 lists the chemicals that are contained in the two rotenone formulations under consideration for use in this project and their calculated initial concentrations in reservoir water (and in a portion of Big Grizzly Creek under some neutralization options) under the Proposed Project and its alternatives. Many of the treatment compounds are regulated under Federal and/or State guidelines as mentioned previously. The presence of these compounds in the lake due to the treatment has the potential for adverse impacts to groundwater quality.

4.2.2 Evaluation Methods and Assumptions

This section presents the assumptions made to determine the degree of groundwater impact from the Proposed Project and the project alternatives. Review of existing data, including information on the geology/hydrogeology of the region and previously collected water level and water quality data is the primary means of assessment of impact to groundwater resources.

4.2.2.1 Geology/Hydrogeology

The following assumptions are made based on previous studies and an understanding of the hydrogeology of the project vicinity. These assumptions are key components used in making the assessment of potential impacts from the treatment alternatives and neutralization options.

- The geology and hydrogeology of the region is as described in the Gardner Report (1999);
- All flow from the tributaries feeding Lake Davis discharge water to the reservoir. This discharge includes direct flow into the reservoir and groundwater seepage. Any groundwater seepage out of the tributaries would be hydraulically upgradient of the reservoir due to the elevations of the tributaries. Therefore, even this seepage would flow to the reservoir as subsurface discharge;
- Springs and seeps above Lake Davis are discharge points for groundwater and not entry ways for treatment compounds to impact groundwater. Water from springs and seeps are surface water discharges to Lake Davis tributaries and eventually Lake Davis;
- Water levels in Lake Davis do not appear to directly affect water levels in private wells as indicated by the existing snapshot of DWR data logger data and hydraulic contour information. However, data has not yet been collected over a year-round period;
- The area of potential effect includes Lake Davis and its surrounding watershed and Big Grizzly Creek with its potential to transmit groundwater as base flow. Deeper

groundwater aquifers used by the City of Portola for municipal supply are separate and distinct from groundwater at Lake Davis.

- Under the neutralization options, all rotenone would be treated within the neutralization zone 0.25 to 0.5 miles below the dam. Some rotenone formulation constituents could be released into the creek from the reservoir for up to 45 days. For the neutralization options at the Grizzly Valley Dam using potassium permanganate, there would only be a potential effect on groundwater in the immediate vicinity (e.g., 2 miles down stream of the dam). Potassium permanganate is readily reduced in the presence of organic matter. Also Big Grizzly Creek is reported to be gaining, not losing, water along this stretch; therefore, the likelihood for treatment chemical or potassium permanganate to migrate into groundwater is very low (Gardner 1999).

4.2.2.2 Alternative Reservoir Elevations

For the seven alternatives, it is assumed that the water level in Lake Davis would be drawn down to approximately the following elevations:

- No Project/No Action: no drawdown
- Proposed Project/Proposed Action: 5,749 feet
- Alternative A: 5,749 feet
- Alternative B: 5,738 feet
- Alternative C: 5,759 feet
- Alternative D: 5,764 feet
- Alternative E: 5,700 feet

4.2.3 No Project/No Action

No Project/No Action (hereafter called No Project) represents a continuation of the existing reservoir and fishery management practices as of September 2005 into the foreseeable future. No Project would not change water levels or water quality in the reservoir. No Project would not result in changes to the reservoir level outside the normal operating range of 38,187 to 58,706 acre-feet at elevations 5,761 to 5,768 feet (see Section 2.2.1). No rotenone formulations would be introduced into Lake Davis. Therefore, there would be no impact on groundwater resources compared to existing conditions, as No Project is the existing condition carried into the foreseeable future.

4.2.4 Proposed Project/Proposed Action – 15,000 Acre-Feet (Plus Treatment)

Under the Proposed Project, the reservoir would be drawn down from an estimated 45,000 acre-feet in January 2007 to 15,000 acre-feet. Liquid rotenone would be applied at a rate of 1.0 ppm to the reservoir, tributary streams, and standing water in the watershed potentially containing northern pike. At 15,000 acre-feet, the surface elevation of Lake Davis is 5,749 feet and the surface area is 1,331 acres. The surface of the reservoir would drop by approximately 15 feet.

4.2.4.1 Public Supply (City of Portola Wells) – Groundwater Levels

The Gardner Report (1999) states "the municipal water supply wells in the City of Portola draw from a geochemically distinct aquifer and so should not be significantly impacted by contaminants from Lake Davis." Therefore, there should be no impact on groundwater levels at the City of Portola wells due to the Proposed Project. These wells could remain a source of water supply.

Impact G-1: Municipal water supply wells in the City of Portola draw from a geochemically distinct aquifer; and so would not be impacted by fluctuating reservoir levels from the Proposed Project. There would be no adverse impact on groundwater levels at the City of Portola wells due to the Proposed Project.

Mitigation G-1: No mitigation is required.

4.2.4.2 Public Water Supply (City of Portola Wells) – Groundwater Quality

The Proposed Project would have no impact on groundwater quality in the City of Portola wells, because these wells draw water from an aquifer that is distinct from the reservoir and would not be impacted by contaminants (Gardner 1999).

Impact G-2: The Proposed Project would have no adverse impact on groundwater quality in the City of Portola wells. These wells draw water from an aquifer that is distinct from Lake Davis. No impact would occur.

Mitigation G-2: No mitigation is required.

4.2.4.3 Wells in the Vicinity of Lake Davis – Groundwater Levels

The wells in the vicinity of Lake Davis have the potential to be adversely affected by the decline in reservoir level of 15 feet to the 15,000 acre-feet pool under the Proposed Project. Nevertheless, the nearest located well is about 1,000 feet from the reservoir (Spangler, personal communication 2006), and data collected by DWR to date have not shown a direct connection between well water and reservoir water levels, suggesting that such an impact is unlikely.

Even though the impact would be less than significant, it is prudent to continue the DWR groundwater level monitoring program.

Impact G-3: The Proposed Project would have a less than significant adverse impact on well levels in the vicinity of Lake Davis.

Mitigation G-3: Well level monitoring will continue. If well monitoring results indicate significant impacts, the impacts will be mitigated by providing alternative water supplies.

4.2.4.4 Wells in Vicinity of Lake Davis – Groundwater Quality

Well-monitoring data from the DFG and DHS as well as the on-going water quality monitoring program conducted by PCEH indicates that chemicals associated with the 1997 treatment of the reservoir have not affected well water quality. For the Proposed Project and alternatives including the use of rotenone, initial concentrations of the chemicals in the rotenone formulations would be below MCLs (see Table 4.1-4). Initial concentrations would be present at the time of treatment and would then decrease as described in Section 14. In the unlikely event that compounds entered the groundwater, they would need to migrate though a minimum of 1,000 feet of aquifer, providing even further dilution and breakdown.

Potential exists for rotenone formulations applied to the tributary streams to impact groundwater resources. Water that flows from the tributaries into the reservoir has the same environmental fate as water already in the reservoir. Potential for water to seep out of the tributaries into the underlying groundwater also exists. The Gardner Report states that groundwater flow direction in the vicinity of the reservoir is towards the reservoir. Seepage out of the tributaries would, most likely, enter the reservoir eventually as groundwater discharge through the lake bed.

Due to (1) the lack of detections after the 1997 treatment, (2) the proposed concentrations and residence times of chemical components associated with the Proposed Project, (3) the direction of groundwater flow currently being towards the reservoir, and (4) the nearest located wells being about 1,000 feet (Spangler, personal communication 2006) from the reservoir, it is concluded that the Proposed Project would have a less than significant impact on groundwater quality in the private wells near the reservoir. In general, Big Grizzly Creek is groundwater discharge area, and the prevailing groundwater flow is towards the creek. It is unlikely that rotenone formulation constituents would enter wells in close proximity to the creek. Furthermore, rotenone is highly adsorbed onto sediments which would prevent it from migrating through groundwater. Other rotenone formulation constituents should rapidly degrade and/or exhibit high sediment adsorption. Should wells in close proximity to the creek draw on surface water containing rotenone formulation, the rotenone formulation constituents should be below detection levels for reasons cited above. Therefore, it is concluded that the Proposed Project would have a less than significant impact on these wells along Big Grizzly Creek.

Nevertheless, it is prudent to continue groundwater quality monitoring in the well network currently utilized by PCEH.

Impact G-4: The Proposed Project would have a less than significant adverse impact on groundwater quality in wells in the project vicinity.

Mitigation G-4: No mitigation is required. However, well monitoring will continue. A well monitoring program will be developed if and as required by, and in consultation with, the California Department of Health Services and the Central Valley Regional Water Quality Control Board and in coordination with the ongoing Plumas County Environmental Health well testing program. If well monitoring results indicate significant impacts, the effects would be mitigated by providing alternative water supplies.

4.2.4.5 Neutralization Options

The Proposed Project and Alternatives A through D each include four neutralization options. One allows the rotenone in Lake Davis to degrade through natural processes. To prevent the release of rotenone from Lake Davis into Big Grizzly Creek prior to natural degradation of the chemical, a number of different neutralization options have been set forth. Potassium permanganate (KM_nO_4) is a strong oxidizer commonly used as a bactericide, a fungicide, and an algaecide. It is also commonly used to neutralize rotenone. Neutralization options are described in detail in Appendix E and summarized in Section 2.7.4.

Option 1: Pumpback to Reservoir–No Chemical Neutralization

All outflow from Lake Davis would be eliminated and dam seepage would be returned to the reservoir by pumps and pipes or tanker trucks. Rotenone would be fully neutralized prior to release of any reservoir water into Big Grizzly Creek. There would be no use of potassium permanganate. All flow in a stretch of 150 yards directly below the dam would cease. Flow beyond the dry stretch would be provided by spring at about 60 gallons per minute.

It is assumed that rotenone would be fully neutralized prior to introduction back into Big Grizzly Creek and potential migration into groundwater. Furthermore, the nearest groundwater well is located over 2,000 feet from the dam, and the GLRID well is located over 5,000 feet from the dam. Data collected from these wells demonstrate they are not fed by Big Grizzly Creek, therefore no impacts are expected from neutralization.

Although flow in the creek would be temporarily reduced (up to 45 days), flow would be maintained by a spring located downstream from the dam. Because wells in the vicinity of the Big Grizzly Creek are recharged from the surrounding watershed and not Big Grizzly Creek, no impacts to well levels are anticipated.

Impact G-5: Neutralization Option 1 would have no impact on groundwater levels for wells downstream of the dam, because these wells are recharged from the surrounding watershed.

Mitigation G-5: No mitigation measures are required. Well level monitoring will continue. If well monitoring indicates significant impacts, alternative water supplies would be provided.

Impact G-6: Neutralization Option 1 would have no impact on groundwater quality as rotenone would be fully contained in Lake Davis eliminating the risk of rotenone entering groundwater.

Mitigation G-6: No mitigation measures are required.

Impact G-7: Neutralization Option 1 would have no impact on groundwater quality as rotenone would be fully neutralized prior to discharge to Big Grizzly Creek.

Mitigation G-7: No mitigation measures are required.

Option 2: Offstream Neutralization of Minimal Flows

Flow from the dam would be curtailed for five days as the rotenone is mixed in Lake Davis. The rotenone-treated water would be neutralized off-stream with potassium permanganate that would be mixed with reservoir water in baker tanks below the dam. The neutralized water would be passed through a filtration system and then returned to the creek. Flows would be reduced to 0.2 to 0.5 cfs for 14 to 45 days in Big Grizzly Creek below the dam.

Impacts G-5 and G-6 from Option 1 above apply to Option 2.

Option 3: Flow Releases of 1 to 2 cfs with Instream Treatment with KM_nO_4

Flow from the dam would be curtailed for five days to allow the rotenone to mix. Subsequently, 1 to 2 cfs would be released from the dam and treated in-stream with potassium permanganate. Some rotenone formulation constituents could be released into the stream from the reservoir for up to 45 days. Under this option, a neutralization zone up to 0.5 miles below the dam would be used for the instream neutralization. Some formulation constituents and KM_NO4 would therefore be present in the creek in, and possibly below, this zone of neutralization.

Impact G-5 from Option 1 above applies to Option 3.

Under Neutralization Option 3, potassium permanganate and rotenone formulation constituents could be released into Big Grizzly Creek for up to 45 days. In general, Big Grizzly Creek is a groundwater discharge area. The entry of potassium permanganate and/or rotenone formulation constituents into wells is highly unlikely because the prevailing groundwater flow is towards the creek, away from local wells. However, wells in close proximity to the creek that may be directly influenced by surface water (e.g., drawing surface water) have the potential to draw creek water containing rotenone formulation. Potassium permanganate is rapidly reduced (degraded) in the presence of rotenone and other organic matter and, therefore, has little potential to migrate through groundwater. Rotenone is highly adsorbed onto sediments, preventing it from migrating through groundwater. Other formulation constituents, at the 'worst case' surface water concentrations modeled in Appendix J, should also rapidly degrade and/or also exhibit high sediment adsorption. They would not be expected to migrate significantly through groundwater.

Impact G-8: Based on hydrologic, physical and chemical properties, concentrations of rotenone formulation constituents and potassium permanganate are anticipated to be below detection levels in all wells in close proximity to Big Grizzly Creek. Therefore, it is concluded that Neutralization Option 3 would have a less than significant adverse impact on groundwater quality in wells near Big Grizzly Creek.

Mitigation G-8: No mitigation measures are required. However, well monitoring will continue. A well monitoring program would be developed if, and as required by, and in consultation with the California Department of Health Services and the Central Valley Regional Water Quality Control Board and in coordination with the ongoing Plumas County Environmental Health well testing program. If well monitoring results indicate significant impacts, the effects would be mitigated by providing alternative water supplies. Alternative sources would include trucking in water and/or providing additional storage to replenish supply.

Option 4: Flow Releases of 3 to 5 cfs with Instream Treatment with KM_nO_4

Flow from the dam would be reduced to leakage for a 5-day period while rotenone is mixed in the reservoir. Water would be released from the dam at 3 to 5 cfs, and neutralized in-stream with potassium permanganate as described in Option 3.

Impact G-5 from Option 1 and G-8 from Option 3 apply to Option 4.

4.2.5 Alternative A – 15,000 Acre-Feet (Plus Treatment Including Powder)

Alternative A is similar to the Proposed Project. However, powdered rotenone (ProNoxfish®) would be used in the reservoir, and liquid rotenone (Noxfish® or CFT Legumine®) would be applied to the tributary streams, pools, ponds, and springs in the watershed that could contain pike. The reservoir would be drawn down to 15,000 acre-feet. With a surface elevation of 5,749 feet, the surface area of Lake Davis would be 1,331 acres. Groundwater impacts to both public and private wells, to groundwater levels and groundwater quality, and mitigation measures are the same as those indicated above in Section 4.2.4, Proposed Project/Proposed Action.

4.2.6 Alternative B – 5,000 Acre-Feet (Plus Treatment)

Under Alternative B, the reservoir would be drawn down by 26 feet in elevation to 5,000 acre-feet in volume and liquid rotenone would be applied throughout the reservoir shoreline areas, tributary streams, and to any pools, ponds, and springs in the watershed potentially containing northern pike. At a volume of 5,000 acre-feet, the surface elevation of Lake Davis is about 5,738 feet and the surface area is about 545 acres.

Groundwater impacts and mitigation measures are similar to those indicated above in Section 4.2.4, Proposed Project/Proposed Action.

4.2.7 Alternative C – 35,000 Acre-Feet (Plus Treatment)

Under Alternative C, the reservoir would be drawn down to 35,000 acre-feet and a liquid rotenone formulation would be applied throughout the reservoir, shoreline areas, tributary streams, and to any pools, ponds, and springs in the watershed potentially containing pike. With a volume of 35,000 acre-feet, the surface elevation of Lake Davis is 5,760 feet and the surface area is about 2,429 acres. The drawdown would lower lake levels by approximately 5 feet.

Groundwater impacts and mitigation measures are the same as those indicated above in Section 4.2.4, Proposed Project/Proposed Action.

4.2.8 Alternative D – 48,000 Acre-Feet (Plus Treatment)

At a volume of 48,000 acre-feet, the surface elevation of Lake Davis is about 5,764 feet, and the surface area is about 2,918 acres. It is similar to the level of the reservoir for the previous treatment in 1997 and does not require refill.

Groundwater impacts and mitigation measures are the same as those indicated above in Section 4.2.4 Proposed Project/Proposed Action.

4.2.9 Alternative E – Dewater Reservoir and Tributaries (No Chemical Treatment)

Under Alternative E, the eradication of pike from Lake Davis would be accomplished by systematically dewatering the reservoir and all water sources flowing into it. Any water-filled depressions within the project area, stream channels, overflow areas, or other standing water areas would be drained. Streams would be dewatered from a point upstream of the reservoir by creating sections and bridging the sections with pipe to allow water flow to continue around the drying area. Areas would be maintained in a dry condition long enough to ensure all pike were eliminated. Dewatering would continue downstream until the reservoir is reached. Under Alternative E, no piscicides would be used. The surface of the reservoir would drop by approximately 64 feet.

Impact G-1 on groundwater levels in Section 4.2.4, Proposed Project/Proposed Action, applies to Alternative E.

4.2.9.1 Public Water Supply (City of Portola Wells) – Groundwater Quality

No rotenone formulations would be applied to the reservoir in Alternative E.

Impact G-9: Alternative E would have no impact on groundwater quality in the City of Portola wells.

Mitigation G-9: No mitigation measures are required.

4.2.9.2 Wells in the Vicinity of Lake Davis – Groundwater Quality

No rotenone formulations would be applied to the reservoir in Alternative E.

Impact G-10: Alternative E would have no impact on groundwater quality in the wells in the project vicinity.

Mitigation G-10: No mitigation measures are required.

4.2.9.3 Wells in the Vicinity of Lake Davis – Groundwater Levels

The wells in the vicinity of the reservoir have the potential to be adversely affected by complete reservoir dewatering. There is not enough current information on the well construction details, and characteristics of the aquifer to make a definitive assessment of impact from full reservoir dewatering.

Given the significant and sustained water level drops, there is the potential for a significant but mitigable impact. This impact should be temporary as water levels would return to normal levels when the reservoir is refilled. However, refill would take 6 to 80 months with a 75 percent likelihood of refill by 41 months past treatment. It is prudent to continue the DWR groundwater level monitoring program.

Impact G-11: Alternative E would have a significant but mitigable impact on groundwater levels in wells in the vicinity of Lake Davis.

Mitigation G-11: Monitor private wells and provide alternative backup supplies if well capacity falls below a functioning level until the reservoir refills or the aquifer is recharged by winter precipitation. Alternative backup supplies would include trucking in water and/or providing additional storage to replenish supply. This mitigation should be temporary, as well levels would recover with reservoir refill.

Significance After Mitigation: Less than significant.

4.2.10 Cumulative Impacts

The analysis of cumulative groundwater resources impacts is based on the contribution of project effects, in conjunction with effects of past, present and reasonably foreseeable actions considered in this EIR/EIS (Table 1.8-1). Impacts on groundwater resources associated with the proposed pike eradication project are: groundwater levels and groundwater quality. This cumulative analysis focuses on the project alternatives only, and does not consider the No Project/No Action alternative. Impacts are considered for the area encompassing Lake Davis and Big Grizzly Creek to the City of Portola.

4.2.10.1 Cumulative Impacts on Groundwater Levels

Public Water Supply (City of Portola Wells)

Under all of the project alternatives, including the Proposed Project/Proposed Action, the pike eradication project would not impact groundwater levels within the City of Portola because the City's wells are drawn from a different aquifer than that associated with Lake Davis. Therefore, the alternatives associated with the pike eradication project would not contribute incrementally to any cumulative impact on groundwater levels associated with the City of Portola's wells. Based on estimates made in the City of Portola General Plan 2020, the City has maximized use of the existing groundwater sources.

Wells in the Vicinity of Lake Davis

Only under the Proposed Project and Alternatives A, B, C, and E would the pike eradication project have a potential to impact groundwater levels by drawing down reservoir levels and subsequently groundwater levels. In the context of cumulative impacts, other projects that could result in similar effects on groundwater levels must be considered in the cumulative impact analysis. Most projects listed in Section 1.8 would not affect groundwater levels in the Lake Davis vicinity. The Grizzly Ranch Development Project is currently using well water to supply water to the development. Local property owners have cited examples of their groundwater levels declining when the Grizzly Ranch golf course is irrigated. Grizzly Ranch water wells are recharged from the surrounding watershed and not Lake Davis, therefore, no adverse cumulative effects with respect to groundwater supplies or levels are expected.

4.2.10.2 Cumulative Impacts on Groundwater Quality

Public Water Supply (City of Portola Wells)

As stated in the Groundwater Levels – Public Supply section above, the City of Portola's wells draw water from a different aquifer than that associated with Lake Davis. Therefore, the alternatives associated with the pike eradication project would not impact groundwater quality within the City of Portola and would not contribute to a cumulative impact.)

Wells in the Vicinity of Lake Davis

The pike eradication project proposes to treat Lake Davis with rotenone formulations to eliminate pike populations. Chemicals added to Lake Davis water have the potential to migrate into groundwater supplies. Under the Proposed Project and alternatives A, B, C, D, and the Proposed Project/Proposed Action the pike eradication project is anticipated to cause less than significant impacts on groundwater quality. (Alternative E does not include chemically treating Lake Davis; therefore, it would have not impact on groundwater quality.) In the context of cumulative impacts, other projects that could result in similar effects on groundwater levels must be considered in the cumulative impact analysis. Most projects listed in Section 1.8 would not affect groundwater quality in the Lake Davis vicinity. However, the DFG's 1997 eradication project included chemically treating Lake Davis to eradicate pike populations. A two-phase groundwater quality monitoring program (DFG and DHS sampling immediately post-treatment, and an ongoing PCEH groundwater well monitoring) was included as part of the 1997 eradication project. These sampling programs have demonstrated and continue to demonstrate that groundwater quality was not affected by the chemical treatment of Lake Davis. Therefore, the cumulative effects of the proposed pike eradication project on groundwater quality would be less than significant under alternatives that include a treatment component (Proposed Project, Alternatives A, B, C, and D).

4.2.11 Environmental Impacts Summary

Impacts are summarized in Table 4.5-1. For all of the project alternatives, there is no impact to City of Portola wells because the city wells draw from a geochemically distinct aquifer.

For wells near Lake Davis, there does not appear to be a direct connection between well water and reservoir water levels. Groundwater flow direction in the vicinity of the reservoir is towards the reservoir. Furthermore, neutralization options including potassium permanganate applications in Big Grizzly Creek would not impact local wells. The only alternative with a significant impact is Alternative E, where complete dewatering of the reservoir has the greatest potential for impacting local wells due to the sustained water level drop associated with a longer refill period.

Table 4.5-1. Summary Comparison of Impacts of Alternatives and Non-degradation

Affected Resource and Area of Potential Impact	Alternative						
	No Project Compared to Existing Conditions	Proposed Project	A	B	C	D	E
Groundwater							
1. Public Supply (City of Portola Wells) – Groundwater Levels	N	N	N	N	N	N	N
2. Public Supply (City of Portola Wells) – Groundwater Quality	N	N	N	N	N	N	N
3. Private Supply (Wells in Vicinity of Lake) - Groundwater Levels	N	LS, A	LS, A	LS, A	LS, A	N	SM, A
4. Private Supply (Wells in Vicinity of Lake) – Groundwater Quality	N	LS, A	LS, A	LS, A	LS, A	LS, A	N

Key:

A = Adverse Impact (NEPA)
B = Beneficial Impact (NEPA)
LS = Less than Significant Impact (CEQA)
N = No Impact (CEQA, NEPA)
SM = Significant but Mitigatable Impact (CEQA)
SU = Significant and Unavoidable Impact (CEQA)

4.2.12 Monitoring

The DFG has initiated a groundwater level monitoring program with the California Department of Water Resources that will continue. Portions of the monitoring program may be supplemented or modified in consultation with the California DWR, DHS, and/or Plumas County Environmental Health.

The DFG will continue to fun a well monitoring program by Plumas County Environmental Health. The monitoring program may be supplemented or modified in consultation with, and as required by, the California Department of Health Services and in consultation with Plumas County Environmental Health.